An Art Program to Maintain and Improve Swallowing Function Focusing on Respiratory Rehabilitation - Practice and Evaluation of Physical and Mental Functions of a Program to Encourage Continuous Efforts -

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Focusing on respiratory rehabilitation for maintaining and improving swallowing function, we have developed a program that involves production of an artwork with smiling face icons into which breath is blown. As a result, a significant difference in the average scores on a face rating scale before and after the art program indicated a mood improvement effect. This shows that the program using smiling face icons has beneficial psychological effects on seniors requiring primary nursing care. Sustaining patients' motivation to perform simple and repetitive exercises is an issue to be addressed in conducting rehabilitation aimed at the recovery of physical functions. The rehabilitation session consisted of strongly blowing into a doll, 10 times in a row, and the subjects went through one such session per day for 30 days. The results of the MWST, RSST, and MPT tests conducted after completion of the rehabilitation sequence showed that their swallowing function remained in as good condition as before the sequence. As the participants completed the full 30-day sequence of respiratory rehabilitation sessions it indicates the program using artworks created by participants is effective for sustaining rehabilitation on a long-term basis.

Keywords: Art Program; Swallowing Function; Respiratory Rehabilitation

1 Introduction
Japan’s population is aging rapidly, with people aged 65 or over exceeding 27% of the total population in 2016. Among these, the number of those who have been certified as requiring nursing care or support under Japan's nursing care insurance system exceeded 6,292,000 individuals as of the end of January 2017, which corresponds to roughly 18% of the elderly population, and represents a roughly 1.43-fold increase from 4,410,000 at the end of April 2007 [The Cabinet Office, 2017]. Against this backdrop, the number of nursing homes for seniors requiring primary nursing care was 9,726, and the number of service recipients was 577,000, as of 2017 [The Ministry of Health, Labour and Welfare, 2017], with still greater demand expected in the future.

While origami, painting, and handicrafts are being implemented as part of recreational activities at nursing homes, the quantitative effects of these creative activities on cognitive and physical functions have not been elucidated. Previous studies have investigated the mood of inpatients in palliative care wards and paediatric medical facilities, and have...
confirmed there is a beneficial psychological effect on participants' moods when art programs called ‘Active Art’ involving tactile motion are implemented [Yoshioka, K., 2013, Yoshioka, K. et al., 2015, and Yoshioka, K., 2015]. The workshop program with ‘Active Art’ in palliative care, intended to encourage art creation movement through the use of colors that draw the eye, and textures with an appealing feel to the hand, was developed. Evaluations of patient’s mood were made before and after the program, and patients behavior were observed. Patient mood after the program was confirmed to have improved significantly in comparison with before the program. Patient interviews conducted after the program indicated that program was evaluated highly in the categories of ‘fun’, ‘satisfaction’ and ‘refreshing’ (Fig. 1).

On the other hand, in the ‘Active Art’ program in pediatric medical facilities, the participants created a nurse call button of clay and use their completed works to simulated communication with the nurse. Since the participants' works had eyes and a mouth similar to creatures, they were encouraged to maintain eye contact and converse with their works. In this workshop, we analysed ratings of the participants' psychological and physiological measurement, and behavior observation. The participants’ mood improved after the program in comparison with that before the program. The blood pressure of participants showing no mood change before and after the program declined, and these participants were suggested to relax (Fig. 2).

Among the main causes of death in Japan, the mortality rate of pneumonia is increasing, with pneumonia replacing cerebrovascular disease in third place from 2011. Roughly 70% of patients with pneumonia are elderly people aged 75 or over, and more than 70% of these
have aspiration pneumonia [The Ministry of Health, Labour and Welfare, Sept. 2016]. While the main approaches to preventing aspiration, pneumonia are oral care and diet, one study has reported that training using sport blowguns is an effective rehabilitation method for maintaining and improving the swallowing function [Kawahima, T. et al., 2010]; and another study suggests that the oral and respiratory muscle functions are improved by continuing expiratory muscle strength training for eight weeks [Ito, N. and Watanabe, S., 2017].

Focusing on respiratory rehabilitation for maintaining and improving the swallowing function, we have developed a program that involves production of an artwork into which breath is blown (patent pending). The present study evaluates the results of implementing the program with elderly people who need long-term care at one nursing home. We investigated the practicability of art creation by elderly people whose cognitive capability has declined, and evaluated the psychological effect of implementing the program. Further, we investigated the possibility of sustained respiratory rehabilitation using the artworks they produced, and the resultant effects on their swallowing function.

2 Implementation and psychological effects of the developed art program

2.1 Description of the program

An art program involving the creation of a matryoshka-style doll into which breath is blown, was implemented with elderly requiring long-term care, as described below.

The materials for the artwork included a matryoshka-shaped base model made of corrugated cardboard packed with newspaper (Fig. 3), handmade Japanese paper in various colors, and face parts. To enable the participants to create their artwork according to their capability, the author prepared different options corresponding to different levels of ability (such as choosing desired Japanese paper pieces, tearing them into smaller pieces, and pasting these onto the model; or choosing desired pre-torn Japanese paper pieces and pasting these onto the model), to encourage their active participation in the artwork creation (Fig. 4). Previous studies on "smiling face icons" noted a psychological effect of mood improvement through the arrangement and drawing of a smiling face icon composed of simple eye and mouth shapes [Yoshioka, K., 2017]. On the basis of such studies, the author allowed participants in this study select their favorite face parts (hair, eyes, and cheeks), paste the selected parts onto the model, and draw a mouth to create a smiling face. Each participant was also asked to give a name to their doll, so that he or she could feel an attachment to the completed artwork.

The completed artworks were then used for respiratory rehabilitation to maintain and improve the participant's swallowing function. To encourage a continued relationship between the participants and their artworks, a sensor that responds to exhalation (sound and pressure) and a module that generates an electronic beep in conjunction with the sensor were installed in the center of each model (Fig. 5). The sensor responds when a person puffs into the doll through a straw inserted in a tube hole on the front side of the doll.
2.2 Implementation of the program

The art program (Fig. 6) was implemented with 12 nursing home residents (two males and ten females) with levels of Japanese nursing care requirements from Level 2 to 4, and psychological assessments were carried out before and after the program, using a face rating scale (Wong-Baker FACES Pain Rating Scale, Fig. 7). Face rating scales are used to assess pain in childhood cancer treatment. For the assessments, the participants were
asked to look at the face scale and point to the face which best represented their mood at that time. As they provide a simple scale for evaluating moods through the selection of specific facial expressions, in this study they were utilized for the psychological assessment of elderly people whose cognitive capability has declined.

To develop a respiratory rehabilitation program for maintaining and improving the swallowing function, a preliminary experiment was conducted after completion of the art program, for ten days (performed on alternate days for each participant). In the experiment, the participants placed their own artworks in front of them during tea breaks, and blew into them, while their relational behavior with the artwork was observed by care staff.

![Artworks created in the art program](image)

**Figure 6. Artworks created in the art program**

![Wong-Baker FACES Pain Rating Scale](image)

**Figure 7. Wong-Baker FACES Pain Rating Scale [Wong DL, Baker CM., 1988]**

### 2.3 Results

Of the twelve participants (hereafter labelled A to L) assessed, using the face rating scale, before and after completion of the art program which took approximately one hour, eight showed an improved mood after the program, four showed no change in mood, and none showed a worsened mood (Fig. 8). Two of the four participants whose mood did not change registered the top-scoring mood both before and after the program. In comparing average scores on the face rating scale, statistical processing was conducted on the assumption that the distances between the facial expressions are all equal. A variance analysis involving one factor and two levels showed a significant difference ($p < .005$) between before and after the program (Fig. 9), confirming the observed mood improvement. This indicates that psychological assessment using the face rating scale is also applicable to elderly people with reduced cognitive capability.
With regard to the continued relationship with the completed artworks, ten of the participants were observed blowing into their completed artworks, while the other two participants were not subject to observation because of overnight absence or other reasons. More than half of the ten observed participants remembered creating their artwork, looked at the artwork affectionately, called its name, studied its expression, and/or willingly went to the location where the artwork was placed. A follow-up survey conducted six months after completion of the art program showed that among the ten participants above, three were displaying their artworks at home, and six were displaying them in their nursing facility rooms. One was observed cherishing her artwork by displaying it in her room, next to a picture of a deceased family member (Fig. 10).

Among other things, members of the care staff who observed the participants said in an interview: "They treated the dolls like their own children as the level of cognition improved, and this was all the more effective," and "They showed a stronger attachment to the dolls because they had themselves created them."

![Figure 8. Comparison of scores on the face rating scale before and after the art program](image)

![Figure 9. Comparison of average scores on the face rating scale before and after the art program](image)
Figure 10. Examples of treatment of artworks six months after completion of the art program, suggesting affection and respect; the artwork is displayed (a) next to the picture of a deceased family member, (b) as part of a Buddhist altar

2.4 Discussion
The significant difference in the average scores on the face rating scale before and after the art program indicates a mood improvement effect from the program. This shows that the program using smiling face icons has beneficial psychological effects on elderly requiring primary nursing care.

In the present study’s program, participants were offered different options for their choice of materials, enabling them to create artworks according to their capability. The program also incorporated design-based elements to encourage active participation in their artwork’s production, such as selecting facial parts (hair, eyes, and cheeks), drawing a mouth, and giving names to their artwork. The fact that all the participants were able to complete their artworks within about an hour indicates that the program was successful in encouraging creative activity in elderly people with reduced cognitive capability.

A continued relationship between the participants and their artworks was confirmed by the fact that all ten observed participants blew into their artworks. Further, they remembered creating the artwork, looked at it with affection, called its name, studied its expression, and/or willingly went to the location where the artwork was placed, all of which indicate attachment to their own artwork. These results suggest that creating a continued relationship between the program participants and their artwork can enhance their motivation for respiratory rehabilitation, which is beneficial in maintaining or improving their swallowing function.
3 Implementation of rehabilitation using artwork
Sustaining patients' motivation to perform simple and repetitive exercises is an issue to be addressed in conducting rehabilitation aimed at the recovery of physical functions. The results of the investigation described in Section 2 show that it may be possible to encourage elderly people with reduced cognitive capability to perform respiratory rehabilitation in a sustained manner, using artworks they have created. Below, the study investigates the possibility of such sustained exercise and the resultant effect on the swallowing function.

3.1 Structure of the respiratory rehabilitation
Two of the participants in the art program were selected for further study, given their physical condition and cognitive capability. They were both female, and corresponded to I and L in Fig. 6, with a level of nursing care requirement of 2 or 3, and with non-reduced swallowing function. Each rehabilitation session consisted of strongly blowing into their doll 10 times in a row, and the two subjects went through one such session per day for 30 days. Immediately before the first session, and after the last session, the subjects' swallowing function was investigated using the modified water swallow test (MWST), the repetitive saliva swallowing test (RSST), and the maximum phonation time (MPT) test. The details of these tests are as follows.

- **Modified water swallow test (MWST)**
  
  Each subject takes 3 ml of water into his or her mouth and swallows it for investigation of swallowing provocation, coughing, or respiratory change. The test result is determined by selecting from the following five items.

  (1) Not swallowed (coughing and/or respiratory distress)

  (2) Swallowed (respiratory distress)

  (3) Swallowed (sound respiration; coughing and/or wet hoarseness [characterized by a phlegmy gurgling sound])

  (4) Swallowed (sound respiration, no coughing)

  (5) In addition to (4), two or more swallows are achieved in 30 sec.

- **Repetitive saliva swallowing test (RSST)**

  This test records the number of repetitive saliva swallows achieved in 30 sec. The test result is normal if the number is three or more, and abnormal if the number is two or less.

- **Maximum phonation time (MPT) test**

  Here the subject is requested to say "Aaah" as long as possible with one breath, and the longest time among three trials is recorded.

A running record of the rehabilitation exercises conducted over the 30 days was maintained by pasting a sticker on a sheet after the completion of each session, resulting in a series of bouquet images when the 30-day sequence was completed (Fig. 11).
3.2 Results
The results of investigating the swallowing function are shown in Table 1. The modified water swallow test (MWST) on participants I and L resulted in a score of 5, both before and after the rehabilitation sequence, indicating that a good condition was maintained, with sound respiration, no coughing, and two or more repetitive swallows in 30 sec. In the repetitive saliva swallowing test (RSST), the subjects were able to swallow saliva three times in 30 sec both before and after the rehabilitation sequence, indicating that they remained in good condition with no decline in the swallowing function. The results of the maximum phonation time (MPT) test exhibited slight variation before and after the rehabilitation sequence, with participants I and L showing a decrease of 2.21 sec and an increase of 0.03 sec, respectively. Both subjects completed the full 30-day rehabilitation sequence.

<table>
<thead>
<tr>
<th>Participant</th>
<th>MWST before</th>
<th>MWST after</th>
<th>RSST before</th>
<th>RSST after</th>
<th>MPT before</th>
<th>MPT after</th>
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<tr>
<td>I</td>
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<td>5</td>
<td>3</td>
<td>3</td>
<td>22.13</td>
<td>19.91</td>
</tr>
<tr>
<td>L</td>
<td>5</td>
<td>5</td>
<td>3</td>
<td>3</td>
<td>2.85</td>
<td>2.88</td>
</tr>
</tbody>
</table>

3.3 Discussion
The results of the MWST, RSST, and MPT tests conducted after completion of the rehabilitation sequence showed that the swallowing function remained in as good condition as before the sequence. Since no changes were observed in the other two evaluation items, it is not likely that the slight variation in the MPT results was due to the implementation of the rehabilitation sequence. Since the two subjects showed no reduction in the swallowing function at the beginning of the sequence, no improvement was found in the swallowing function after the sequence. However, the fact that both completed the full 30-day sequence...
of respiratory rehabilitation sessions indicates that the program using artworks created by participants is effective for sustaining rehabilitation on a long-term basis. It would appear that the continued relationship between the participants and their artworks was effective for maintaining motivation for long-term rehabilitation. In addition, maintaining a record of the rehabilitation exercises by pasting a sticker on a sheet after completing each session, and eventually completing a series of bouquet images to visualize the daily achievements, may also have contributed to the continuation of rehabilitation exercise by the participants.

4 Conclusion
Focusing on respiratory rehabilitation for maintaining and improving the swallowing function, the study developed an art program that generates sustained participant involvement by asking them to blow into artworks they have created (patent pending). The art program was implemented with elderly requiring primary nursing care in a nursing home, to investigate the psychological effect of its implementation, the possibility of continued respiratory rehabilitation exercise using the artworks, and the effect of the exercise on the swallowing function.

It has been shown that the mood of participants improved after implementing the art program, compared with before implementation. The results indicate that a program using smiling face icons has beneficial psychological effects on elderly requiring primary nursing care. By incorporating design-based factors of different options for the choice of materials and facial parts in the program to enable the creation of artworks according to the abilities of individual participants, it was possible to encourage active participation. The participants showed attachment to their own artworks after going through the art program, and their motivation for respiratory rehabilitation exercise was heightened by the creation of a continued relationship with the artwork.

The subjects participating in respiratory rehabilitation sessions for 30 days, using artworks created by themselves, completed the sessions without missing a single day, indicating the possibility of conducting long-term rehabilitation. The participants showed no decline in the swallowing function before starting the sessions and were found to still be in good condition after completing the rehabilitation sequence. Though the duration of the rehabilitation sequence was 30 days in the present study, a study on expiratory muscle strength training has suggested that functional improvement is achieved by continuing rehabilitation exercise for eight weeks [Note 7]. A further related study is therefore needed, with greater sequence duration and evaluation of functional improvements.

In the present study, elderly people with reduced cognitive capability were able to sustain respiratory rehabilitation exercise on a long-term basis using artworks created by themselves. It is probable that the use of artworks created by participants in long-term rehabilitation exercise is effective not only for the supporting the swallowing function but also for various other mental and physical functions, and thus the author plans to extend the present approach in the future.

This research was conducted with the approval of the Research Ethics Committee of Meisei University and the Research Ethics Committee of Sapporo City University.
5 References

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